The next generation operational geostationary sounder

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The era of operational high-spectral-resolution infrared radiance measurements from the geostationary perspective is approaching with the advent of the Advanced Baseline Sounder (ABS), now referred to as the HES (Hyperspectral Environmental Sounder) on GOES-R. These advanced sounders will have over one thousand channels with spectral widths of half wavenumber, while the current GOES Sounders have only 18 bands with spectral widths of tens of wavenumbers. The ABS/HES is likely to be an interferometer that overcomes several existing instrument limitations. Current GOES Sounders are limited in their hourly spatial coverage, their spectral resolution restricting vertical sounding resolution, and their ability to depict boundary layer small scale temperature and moisture changes.

ABS/HES measurements from geostationary orbit will have high temporal resolution (1 hour), high spatial resolution (less than 10km), high-spectral resolution (better than single wavenumber) and wide coverage (hemispheric). These will enable monitoring of the evolution of detailed temperature and moisture structures in clear skies with high accuracy and very high vertical resolution that is not possible with the current GOES sounder. ABS/HES will be able to see the emergence of temperature and moisture inversions in clear skies; thus marking severe weather potential and possible fog formation. High-spectral-resolution sounder radiances will also improve cloud-top pressure estimates.

Temperature and moisture retrievals from current GOES radiance measurements and simulated future ABS/HES radiances are compared with time/space co-located radiosonde observations and numerical weather prediction (NWP) forecasts. The ABS moisture retrievals show significant improvement of over the current GOES sounder and NWP forecasts. In addition, cloud top pressure retrievals from simulated GOES and ABS/HES cloudy radiances also show the advantage of high-spectral radiances in estimating thin high clouds over the current GOES sounder radiances.

Improvements will be realized in nowcasting, short-range weather forecasting, and longer-range numerical weather prediction. The expectations from the ABS/HES are that it will:

* depict water vapor as never before by identifying small scale features of moisture vertically and horizontally in the atmosphere

* track atmospheric motions much better by discriminating more levels of motion and assigning heights more accurately

* characterize life cycle of clouds (cradle to grave) and distinguish between ice and water cloud (which is very useful for aircraft routing) and identify cloud particle sizes (useful for radiative effects of clouds)

* measure surface temperatures (land and sea) by accounting for emissivity effects (the improved SSTs would be useful for sea level altimetry applications)

* distinguish atmospheric constituents with improved certainty; these include volcanic ash (useful for aircraft routing), ozone, and possibly methane plus others trace gases.